ASSESSMENT

There were two fisheries identified in this assessment, commercial and recreational. For each fishery catch and length data were available. There was also one index of abundance used from CDFG's Northern and Central California Commercial Passenger Fishing Vessel (CPFV) Sportfish Survey. This index was treated as a survey in order to have the model recognize separate information on the same (recreational) fishery. This survey, which will be referred to as the "CPFV survey," represented only the CPFV portion of the recreational fishery. Length information from this survey was also provided and used. The data file used in this assessment is provided in Appendix A.

Landings data

Commercial landings date back to 1969 and come from two sources, all converted from pounds to metric tons. We used landings from 1969 to 1977 that were reported on the commercial fish landing receipts from CFIS. In these years, gopher rockfish are assumed to comprise 100% of the gopher rockfish market category. For a background level (1965-1969), we calculated the mean catch from 1969 to 1973 (11 metric tons), which was used in the baseline model.

We obtained the estimated catch for 1978 to 2004 from the California Cooperative Survey (CALCOM) database (B. Erwin, PSMFC, pers. comm.). Expansion procedures were used to estimate commercial landings from sampling commercial market categories (Pearson and Erwin 1997). The gopher rockfish market category does not accurately represent the take of this species, for many rockfish market categories have a variety of species mixed in, primarily driven by size and price factors. This is particularly an issue for the 1980s and 1990s. During the 1980s, there was an additional market category added, "group gopher rockfish," which appears to have affected reported landings for gopher rockfish starting in the mid 1980s. Estimates were made for the years 1984 to 1988 due to low reported landings, some of which were zero (Figure 7). For these estimates, we used species composition information in the 1980s from the gopher and group gopher market categories. An example of species compositions sampled in the group gopher market category in 1989 can be seen in Table 2.

Figure 7 represents the reported landings of gopher and group gopher market categories, as well as the estimates used in the baseline model for the commercial gopher take. Tonnage falling outside of model estimates represents other species also found in these market categories. Around 1999, fishermen and dealers became more aware of what problems this caused for management, so there has been an increased effort to correctly identify species and report them in their appropriate market categories. Additionally, state regulations mandate that any species of nearshore fishes must be sorted by species prior to weighing and the weight reported separately on the CDFG fish landing receipt (Section 150.16, Title 14, California Code of Regulations).

The recreational catch estimates came from two sources. In 1980, the Marine Recreational Fishing Statistical Survey (MRFSS) began in California, and from 1980 to 2003 (with a hiatus from 1990-1992) estimated landings, effort and discards are available from the RecFIN website (http://www.psmfc.org/recfin). No estimates were available for northern California from 1969 to 1982, so estimates based on the ratio of sums of commercial to recreational catches during the 1980s time period were used. For the years 1990-1995, there were missing CPFV estimates in RecFIN, so we used CPFV survey estimates to fill in for those years. Estimates for 1990-1992 for the shore-based and private boat modes of the recreational fishing were based on historical averages. For the year 2004, catch estimates were provided from the California Recreational Fisheries Survey (CRFS), a newly implemented state program that estimates catch and effort along the coast of California (also available from the RecFIN website). All catch estimates used are in Table 3.

We did not include the removals of gopher rockfish taken by spearfishing in this assessment. We evaluated the Central California Spearfishing Tournament (CenCAL) data from 1959-2003 (D. VenTresca, CDFG, pers. comm.), and a minimal amount of gopher rockfish (n=176) was actually taken in those 45 years.

Recreational discards for this assessment were estimated from RecFIN and were included in the total removals for this fishery. For years where no discard estimates were available, we used the ratio of sums of recreational take to discards (in years where information was available) in the 1980s to estimate discards prior to 1990. The same method was used for estimating discards from 1990 on, using the ratio of sums in the 1990s. Evaluation of discard estimates showed an increase in discards in more recent years, hence the two estimates used in the two time periods. Recent changes in bag limits may have increased discards of gopher rockfish in the recreational fishery, although bag sharing (where a fisherman can give fish to another person on the boat who has not reached their limit) may help to minimize this. No correction for the change in bag limit was made in this assessment. Anecdotal information indicates the number of discarded gopher rockfish in 2004 was high. There is also evidence of this increase in the CPFV logbook data and RecFIN data that supports this concern.

Commercial fishermen also stated that permit requirements have caused an increase in discards. The take of gopher rockfish is limited to individuals with a nearshore fishery permit; however gopher rockfish are also caught by individuals targeting deeper nearshore species for which a separate permit is required. Without both permits, individuals would have to discard all gopher rockfish. The National Marine Fisheries Service (NMFS) has been conducting an onboard survey to estimate discards in recent years; however, this information is not yet available.

Catch per Unit Effort (CPUE)

The CPFV survey provided catch and effort data to produce a CPUE index (catch per angler hour) of relative abundance (D. Wilson-Vandenberg, CDFG, pers. comm.) for the time period 1987 to 1998. In the initial analysis of this time series, we analyzed each area separately (Fort Bragg, Bodega Bay, Año Nuevo, Monterey, and Morro Bay) and found that CPUE was

constant through time for each area. For locations where gopher rockfish were not landed for at least 3 years, we removed those locations from the analysis. We then ran a Gaussian Generalized Linear Model (GLM) with year, month and location effects (Table 4). To estimate precision, we used the jackknife function so there would be a variance associated with the index. Fort Bragg "fell out" of the analysis due to a lack of sufficient information to contribute to the GLM. Figure 8 represents the catch per unit effort index from 1987 to 1998 from the CPFV survey.

Another index was considered, using catch and effort information from RecFIN (Figure 9); however after much consideration and a sensitivity analysis removing this index, the STAR Panel requested it be removed from the final baseline model, for it did not provide a reliable measure of relative abundance due to changes in regulations and fishery targeting during the 1990s-2000s. For documentation, the following section explains the analysis performed prior to the removal of this index.

RecFIN CPUE:

Northern California (north of Point Conception) trip-level summaries of partyboat catch and angler effort from the RecFIN database were provided for years up to 2003 (W. VanBuskirk, PSMFC, pers. comm.). These RecFIN intercept data reflect sampling and interviews conducted at the end of a fishing trip, and do not include information on specific fishing locations. Because the data include both relevant trips, in which gopher rockfish were reasonably likely to be taken, and non-relevant trips such as trips targeting salmon or tuna, the logistic regression method of Stephens and MacCall (2004) was used to obtain a subset of the trip data that would be appropriate for calculating gopher rockfish CPUE. This method uses the species composition from each trip catches to determine whether gopher rockfish were likely to have been encountered on that trip.

The top 50 species in frequency of occurrence for each region were extracted, and gopher rockfish were separated as being the target species. The remaining 49 species served as potential explanatory variables. Three species of salmon were combined into a single category. Logistic regression of gopher rockfish presence/absence on categorical presence/absence of these explanatory species provided predicted probabilities that gopher rockfish would be taken on a trip, given the other species that were taken on that trip. Prior to the analysis, some trips were excluded from the data set if they were too short (<0.25hr) or too long (>14hr).

Defining the appropriate subset of the data for use in calculating CPUE requires establishing a threshold probability for inclusion. The threshold probability recommended by Stephens and MacCall (2004) is based on an equal number of false negatives (trips that are excluded from the selected set, but the target is present) and false positives (trips that are included in the selected set, but for which the target is absent). In the case of a relatively rare species it may be desirable to increase the number of positive occurrences of the target species in the subset, i.e., by reducing the number of false negatives despite an increase in false positives. The threshold probability that resulted in the lowest average coefficient of variation (CV) of the annual indexes was used, assuming that up to some point, the CV (as a nominal measure of precision) is marginally improved by the larger numbers of actual positive records more than it is degraded by including a larger number of trips that did not catch the target.

Selection of the threshold probability defines the subset of data to be used for calculation of the CPUE index (catch per angler hour). The abundance index is calculated by a Generalized Linear Model (GLM) using a delta-gamma distribution (R language code provided by Edward Dick, SWFSC). An exploratory GLM including all years, all counties, six two-month waves, and distance from shore (inside/outside three miles from land) effects were first used to determine if the model could be simplified based on similarity of estimated effects. The final GLM was simplified somewhat, and included 17 year effects, six wave effects, six county effects, and two area effects (distance from shore). The year effects served as the abundance time series. Precision of the estimated year effects was estimated by use of a jackknife procedure.

Length Composition Data

Length compositions came from three sources: CALCOM, RecFIN, and CPFV survey data. Since all length composition data were reported in either fork lengths or total lengths (mm), we converted all lengths to fork lengths (Equation 2). Once converted to fork lengths (cm), we set up 2 cm bins to calculate length compositions, starting at 16 cm. We did not have any ages for fish above 40 cm and there were minimal lengths (n=5) above 40 cm, so our range of length bins was from 16-40 cm. Table 5 summarizes the initial sample sizes used in the baseline model. Length compositions for each fishery are also shown in Figures 10a-c.

We obtained commercial length compositions from the CALCOM sampling database that covered years from 1992 to 2004. Length compositions for hook-and-line and trap gears were very similar, so all lengths were combined into one commercial fishery (Figure 11).

We used recreational length information from RecFIN and the CPFV survey. We generated recreational length compositions for the CPFV and private boat sectors from 1993-2004 (as well as 1986) through RecFIN. The 1980s data series in RecFIN showed a weight to length conversion problem, so we did not use that information in this assessment (refer to Figure 9b) except for 1986 data, which appeared to be usable. However, we did provide the model with the mean fish weights for those 1980s years. Length compositions between the CPFV and private boat sectors (Figure 12) were also very similar, so we combined all lengths into one recreational fishery.

Our third source of length information came from the CPFV survey that was conducted from 1987 to 1998 in central and northern California. The minimal length compositions (n=54) from Fort Bragg were removed from this assessment due to the differing size compositions compared to other sources (Figure 13). As explained earlier, the GLM also removed Fort Bragg from the CPUE index, having little, if any, effect.